38 SELF-DESCRIPTIVE NUMBER NAMES

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If one sets A = 1, B = 2, ..., Z = 26, the number-name ONE scores 15 + 14 + 5 = 34, the number-name TWO scores 20 + 23 + 15 = 58, and so on. In the August 1981 **Word Ways**, Edward Wolpow observed that no number-name is self-descriptive; that is, no number-name is equal to its score. (However, TWO HUNDRED NINETEEN has a score of 218, and TWO HUNDRED FIFTY-THREE, 254.) In the November 1989 Kickshaws, David Morice suggested that this melancholy state of affairs could be rectified by rearranging the alphabet; for example, if the alphabet began ISX..., then SIX would score 6. He posed several problems including the following: what alphabet rearrangement yields the maximum number of self-descriptive number-names?

A complete answer to this question undoubtedly requires the services of a digital computer. However, I decided to see how well one might do using only pencil and paper. I used a strategy suggested to me by Leonard Gordon: (1) construct n self-descriptive number-names selected from the set TWENTY, THIRTY, ..., NINETY; (2) construct m self-descriptive number-names taken from the set TWO HUNDRED ONE, TWO HUNDRED TWO, ..., TWO HUNDRED NINE (or, possibly, ONE HUNDRED ONE through ONE HUNDRED NINE); (3) combine these to create an additional mn self-descriptive names of the form TWO HUNDRED EIGHTY-THREE; (4) check to see whether TWO HUNDRED ELEVEN and TWO HUNDRED TWELVE can also be made self-descriptive with suitable choice of L (that is, a number not already used). Gordon's experimentation suggested that it might be possible to set both n and m equal to 5, which would yield 37 self-descriptive number-names.

My pencil-and-paper trial-and-error approach proceeded as follows. (Readers not interested in mathematical details may skip this paragraph if they wish, and go on to the results.) I selected the number-names FIFTY through NINETY to work with, as well as the number-names ONE, TWO, THREE, FOUR, and NINE. Since SEVENTY had to be 20 less than NINETY, I + N = 20 + S + V + E. I arbitrarily selected values for these five letters, grouping them near the ends of the alphabet in order to leave an uninterrupted middle range to work with: N = 26, I = 4, S = 3, V = 5, E = 2. This led to NINE = 58, which implied that T + Y had to be 32, and ONE had to be 50, TWO 51, THREE 52, and FOUR 53. The T + Y requirement in turn dictated that 2F + I had to be 18 (hence F = 7), and that S + I + X had to be 28 (hence X = 21). Since E + I + G + H had to be 48 (if EIGHTY were to equal 80), this in turn required that G + H had to equal 42. If ONE had to be 50, then O was compelled to be 22; this in turn dictated that T + W had to equal 29. And, since FOUR had to be 53 as noted previously, the values established for F and O required U + R to equal 24. To make TWO HUNDRED ONE, etc., come out right, the value of HUNDRED had to be (mirabile dictu!) 100. If D were to be an integer, H + U + N + R + E had to be an even number, which (because of the fact N = 26, E = 4, U + R = 24) meant that H (and therefore G) also had to be even; in fact, H + 2D had to equal 48. The only possible choices for H and G were 24 and 18 (or 18 and 24), because 26 and 22 were already taken by N and X. I set H equal to 18, which implied a D of 15, and then noted that if I assumed a value for T, the remaining unassigned letters (Y,W,U,R) were all determined. To check quickly for possible valid choices of these five numbers, I used a graphical plot in which U and T sloped diagonally down and W, R, and Y, diagonally up.

As a result of the foregoing calculations, I ascertained that the following rearrangement of the alphabet solved the problem:

.ESIV.F.WR.Y.UD..H.TXOLG.N

with A,B,C,J,K,M,P,Q and Z assigned in any order to the nine blanks. This created 37 self-referential number-names:

	201	202	203	204	209	211	212
50	251	252	253	254	259		
60	261	262	263	264	269		
70	271	272	273	274	279		
80	281	282	283	284	289		
90	291	292	293	294	299		

Could an alphabetic rearrangement yield 38 (or even 39) self-referential number-names? Two number-names, TWO HUNDRED FIFTEEN and TWO HUNDRED EIGHTEEN, were the most likely candidates; using the above alphabet, these scored 219 and 249, respectively. When I reported these results to Leonard Gordon, he programmed his personal computer to search for solutions incorporating TWO HUNDRED FIFTEEN or TWO HUNDRED EIGHTEEN, and eventually succeeded with the following alphabetic rearrangement:

REFSW.VG..IXYD.....T.NULOH

which incorporated the 37 number-names I had found, plus TWO HUNDRED FIFTEEN. Can anyone find an alphabetic rearrangement leading to 39 self-referential number-names? It won't be easy!